FLEXIBLE SCREEN DISPLAY WITH TOUCH SENSOR IN A PORTABLE COMPUTER

CROSS REFERENCE TO RELATED APPLICATION

This application is a Continuation-in-Part and claims priority and benefit to co-pending U.S. patent application Ser. No. 09/728,023, filed on Nov. 30, 2000, by Francis Canova Jr., and entitled "MULTI-SIDED DISPLAY FOR PORTABLE COMPUTER," which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a user interface for a portable electronic device. More particularly, the present invention provides a user interface with flexible display panel capabilities and flexible touch sensor capabilities for portable electronic devices.

2. Related Art

Advances in computer technology have enabled the further miniaturization of the components required to build computer systems. As such, new categories of computer systems have been created. One of the newer categories of computer systems is the portable, hand held, or "palmtop" computer system, also referred to as a personal digital assistant or PDA. Other examples of a portable computer system include electronic address books, electronic day planners, electronic schedulers and the like.

A palmtop computer system is a computer that is small enough to be held in the user's hand and as such is "palm-sized." As a result, palmtops are readily carried about in the user's briefcase, purse, and in some instances, in the user's pocket. By virtue of its size, the palmtop computer, being inherently lightweight, is therefore exceptionally portable and convenient.

The continuing miniaturization of computer systems enables a user to now carry in their pocket the equivalent of a computer system that once occupied an entire room. The miniaturization has also reduced the functionality of the palmtop computer system. To support the diminutive form factor of the palmtop computer, certain functions and components normally associated with full sized computers have been reduced or eliminated.

One of the components whose functionality has been reduced is the display panel. To comply with the form factor of the portable computer, smaller graphic panels with reduced graphic resolution have been developed. By virtue of reducing both the size of the display panel and the resolution thereof, less information is now visible to the user.

Additionally, another drawback to the portable computer is the display panel itself. While utilization of the liquid crystal display (LCD) has, in part, enabled the further development of the portable computer system, it is not without some limitations. An LCD is constructed using glass, and as such, is thick, rigid, and relatively heavy for its size. Additionally, liquid crystal displays are usually visible from one position, and as such, the information displayed is often difficult to see. Another drawback is that some LCDs require backlighting for illumination of the display area which is a constant draw on the retained power within a portable computer.

The keyboard, another component that is normally associated with a full sized computer, has, in this instance, been completely eliminated from the form factor of the portable computer. By eliminating the keyboard or alphanumeric input device, an alternative means or device that would enable a user to enter and/or manipulate data had to be developed. One such device that was developed to overcome the elimination of the keyboard, while still conforming to the form factor of the portable computer, is the touchable panel, or touch screen. In essence, the touch panel enables registration and interpretation of contact between the panel and the tip of a stylus utilized by a user. As shown in FIG. **1** (Prior Art), the touch panel is disposed on the top surface area of the LCD, such that it is accessible to the user.

FIG. **1** (Prior Art) is an cross-sectioned illustrated view of exemplary touch panel/LCD device **9**. Frame structures **11**L and **11**R as well as supporting shelves **12**L and **12**R and **13**L and **13**R are disposed, respectively, along the left and right sides of touch panel/LCD **9**. Supporting shelves **12**L and **12**R are designed to provide edge support for top film component **14**. Supporting shelves **13**L and **13**R are designed to provide edge support for substrate component **16**.

FIG. **1** (Prior Art) further depicts, from top to bottom, the various components that comprise touch panel/LCD **9**, which is a combination of touch screen **10** and LCD **20**. Touch screen **10** is comprised of layers **14**, **15**, and **16**. Commencing at the top and moving downward, top film layer **14** is shown. Top film layer **14** is the surface of touch panel/LCD **9** that is contacted by the user's stylus. Spacer layer **15** is shown as disposed below top film layer **14**. Substrate layer **16** is shown as disposed beneath spacer layer **15**. LCD **20**, shown as disposed beneath substrate layer **16** is comprised of layers **17**, **18**, and **19**. Thermotropic liquid crystal layer **18** is shown as sandwiched between upper glass layer **17** and lower glass layer **19**. Backlighter **21**, shown as disposed at the bottom of touch panel/LCD **9**, provides the illumination thereof. In another exemplary example, backlighter **21** may be repositioned below substrate **16** and above upper glass layer **17**, and, accordingly, is termed frontlighting, due to its orientation relative to LCD **20**.

It should be appreciated that in the exemplary touch panel/LCD device, as depicted in FIG. **1** (Prior Art), inherent drawbacks are present. One drawback is the overall height of touch panel/LCD **9**, which is approximately four millimeters, making it relatively thick for a portable computer system.

Another drawback is that, because of the amount of space between the touch surface of the touch screen and LCD, there is what is commonly referred to as the parallax effect. Simply stated, the parallax effect is a type of visual spatial distortion such that the actual point of contact on the touch screen does not correspond to the intended target area of the LCD. This is analogous to a stick being immersed in water, such that the stick takes on a bent or distorted appearance.

An additional drawback is that the amount of light that comes from the LCD through the touch screen to be viewed by the user is only about 80% of the available light. In a reflective display, that amount is further reduced to about 64%. This reduces the overall contrast, clarity, and quality of the display as seen by the user.

SUMMARY OF THE INVENTION

Thus, a need exists for a user interface which overcomes the disadvantages of an LCD (liquid crystal display) in a portable electronic device and which provides touch screen functionality such that the visual quality of the display device is not diminished. An additional need exists for a user